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Document 12.6
LLNL Lockout/Tagout Program

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12.6

LLNL Lockout/Tagout Program*

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* **Minor revision**

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LLNL Lockout/Tagout Program

1.0 Introduction

1.1 Purpose and Scope

The primary purpose of the LLNL Lockout/Tagout (LOTO) Program is to prevent unintended releases of hazardous energy associated with servicing and maintenance activities (see Appendix A for definitions). Where unexpected energization (or startup) of equipment or the release of stored energy could occur and possibly result in injury, the requirements in this document shall be applied to ensure that equipment is stopped, all potentially hazardous energy sources are isolated, and equipment is locked out and tagged out by each worker before those workers begin service or maintenance. The LOTO Program is implemented through LOTO procedures for shutting off and securing such equipment. LOTO procedures shall be strictly followed when it is necessary to work on any equipment that may release any form of hazardous energy, including, but not limited to, electrical, rotational, mechanical, radiation, chemical, hydraulic, or pneumatic energy sources. Construction activities also fall under the scope of this document, specifically construction equipment that poses an energy release hazard to the person who is working on it. The specific procedures in this document are generally more rigorous than those typically used in the construction industry.

Electrical distribution switching activities that fall under the scope of the *High Voltage Distribution System Operation Manual* (available from the Plant Engineering Department) and that are controlled by a switching procedure are not covered by these requirements, although the switching procedure may incorporate LOTO requirements as appropriate.

The term "LOTO-authorized worker," as used in this document, refers to an LLNL employee or supplemental labor worker who is authorized to perform LOTO.

The term "work supervisor," as used in this document, refers to the person designated by management to be the day-to-day supervisor of a LOTO-authorized worker. A work supervisor may be the payroll supervisor of a LOTO-authorized worker assigned a specific, short-term duty in an area. LOTO-authorized workers assigned duties in more than one area may have more than one work supervisor. The work supervisor shall ensure that the LOTO-authorized worker is trained and qualified to perform assigned tasks.

The term "equipment," as used in this document, refers to machines, facility equipment, research and development equipment, and equipment components. Other terms used in this document are defined in Appendix A. Appendix B contains a LOTO Inspection Checklist and a LOTO Inspection Form.

1.2 Applicability

All LLNL employees and supplemental labor workers shall comply with the requirements of the LLNL LOTO Program; however, only LOTO-authorized workers may apply LLNL LOTO locks and tags. Outside subcontractors are required to establish and maintain their own LOTO programs, as specified in Section 3.8.

Workers are required to be trained and designated as LOTO-authorized workers before performing the procedures described in this document.

Individuals with primary responsibility for actions in this program are:

- Personnel who work on equipment that can be reenergized or that has stored energy.
- Work supervisors who monitor workers' actions to verify that LOTO procedures are followed correctly. (See Sections 3.1 and 3.2 for LOTO requirements and Section 4.0 for responsibilities.) Work supervisors shall use the LOTO Inspection Checklist and LOTO Inspection Form shown in Appendix B to assess compliance with the LLNL LOTO Program.
- Equipment supervisors who are responsible for equipment and for notifying affected workers about the energy sources and where those energy sources are located. Notification shall be in writing when the equipment is complicated (e.g., equipment that has two or more energy sources). (See Sections 3.1 and 3.2 for LOTO requirements and Section 4.0. for responsibilities.)

1.3 Exceptions

The LLNL LOTO Program applies to all workers. Outside subcontractors shall use their own LOTO program, as described in Section 3.8.

The following situations do not require LOTO:

- Minor tool changes, adjustments, and other minor servicing activities that take place during normal operations, provided that (1) such activities are routine, repetitive, and integral to the use of the equipment and that (2) the work is performed using alternative measures that provide effective personnel protection.

- Work on cord- and plug-connected electric equipment, provided that (1) exposure to the hazards of unexpected energization is controlled by unplugging the equipment from the energy source and that (2) the plug is under the exclusive control of the worker performing service or maintenance.
- Pneumatic tools may also be exempt, provided that the tools can be completely isolated from their energy source by disconnecting the pressure hoses from the pressure sources.
- Intentional operations on or near energized equipment or systems where the continuity of service is essential to the task, where shutdown of the system is impractical, or where shutting down the equipment presents a greater hazard. In such cases, documented procedures shall be followed, and special equipment that provides proven, effective protection shall be used. See Document 3.4, "Preparation of Work Procedures," in the *Environment, Safety, and Health (ES&H) Manual.*

1.4 Administrative Locking and Tagging

LOTO shall not be used for administrative or operational purposes that do not involve servicing or maintenance of equipment. Instead, such equipment may be locked or tagged with an administrative lock and an appropriate tag. For more details, see Section 3.9.

A careful distinction shall be made between LOTO and various other locking and tagging practices, collectively referred to as administrative locking and tagging. Whereas the LOTO procedure is specifically reserved for situations in which equipment is deenergized for the purpose of servicing or maintenance, administrative locking and tagging normally are not used as the primary means of protection during a servicing or maintenance procedure and are not a substitute for LOTO.

Administrative locking and tagging is distinguished from LOTO in both practice and purpose. An administrative lock may be controlled by a group, rather than an individual, and LOTO locks and LOTO tags shall not be used in administrative locking and tagging.

Administrative locking and tagging may be performed for various reasons, including equipment security, programmatic purposes, or general safety.

Examples of administrative locking and tagging are:

- A locked fence around high-voltage transformers.
- A lock on an overhead-crane disconnect switch.

- A locked door to a laboratory containing hazardous equipment.
- Equipment that is out of order for an indefinite period and locked or tagged to prevent use.

In some applications, it is appropriate to use a combination of administrative and LOTO controls. For example, if one group or shop needs to retain oversight of a utility while others are performing work associated with that system, an administrative lock may be applied by the oversight group in parallel with the individual LOTO devices applied by each worker.

1.4.1 Deactivation and Mothballing

During the deactivation or mothballing of a facility or building, it may be necessary to secure, lock, and tag electrical, compressed air, water, or other utility or programmatic services, even though no maintenance is to be performed. DANGER locks or other appropriate locks may be installed by the facility manager, FPOC, or a LOTO-authorized worker designated by facility management. An administrative lock with a CAUTION tag or other tag that communicates the equipment status may be used. In either case, a log is required, and the keys and log shall be held by the facility manager. When equipment in such areas undergoes maintenance, LOTO locks shall be applied by the maintenance workers. The LOTO locks may be applied in addition to the administrative locks. [See Document 12.7, "Shutdown or Transfer of Facilities, Operations, or Associated Equipment," in the *ES&H Manual*.]

2.0 Hazards

Many of the worst industrial accidents are caused by an accidental release of energy. Energy sources that are not neutralized and locked out have the potential to cause severe injury, disfigurement, or death from electric shock, contact with rotating machinery, burns, or other causes. The LLNL LOTO Program provides procedures that shall be followed to ensure that all potentially exposed workers have exclusive control of the sources and isolating devices that protect them from unanticipated contact with hazardous energy.

3.0 LOTO Controls

All workers who perform servicing or maintenance tasks that fall under the scope of this document are required to affix a personal LOTO lock to the equipment according to the procedures for general LOTO (Section 3.1), equipment-specific LOTO (Section 3.2), or group LOTO (Section 3.3). Therefore, all such workers are required to be trained and

designated as LOTO-authorized workers before performing any such servicing or maintenance activities. See Section 3.13.2 for training requirements.

Affected workers are not required to apply LOTO locks. (An affected worker is a worker who does not perform the servicing or maintenance tasks that fall under the scope of this document but who normally operates or works near equipment on which such servicing or maintenance is performed.)

A LOTO tag without a LOTO lock is not accepted by LLNL as a means of energy control under the scope of this document, except as noted in Section 3.10.

The primary types of LOTO used at LLNL are:

- General LOTO (for any equipment or machine that does not have an equipment-specific written procedure. See Section 3.1).
- Equipment-specific LOTO (see Section 3.2).
- Group LOTO (see Section 3.3).

3.1 General LOTO Procedure

This section describes the requirements pertaining to general LOTO.

3.1.1 Conditions Where the General LOTO Procedure Is Permitted

The general (i.e., single-point) LOTO procedure may only be used for equipment in which all of the hazardous energy is easily isolated with a single action, e.g., the operation of only one switch or one valve. If the equipment meets all of the following criteria, the general procedure may be used, and a specific written procedure for that equipment is not required:

- The equipment has no potential for stored or residual energy (or reaccumulation of stored energy after shutdown) that could endanger workers.
- The equipment has a single energy source that can be readily identified and isolated.
- The equipment is completely deenergized and deactivated by the isolation, lockout, and tagout of the energy source.
- The equipment is isolated from the energy source and locked out and tagged out during service or maintenance.
- A single lock and tag achieves a locked out and tagged out condition.

- The lock is under the exclusive control of the LOTO-authorized worker performing the servicing or maintenance.
- Service or maintenance of the equipment does not create hazards for other personnel.
- The equipment has no record of unexpected activation or reenergization during service or maintenance.

3.1.2 General LOTO Steps

LOTO of electrical systems whose voltage or stored energy is equal to or greater than 245 volts or 10 joules is considered to be work on energized equipment and is therefore classified as a Class 3 or Class 4 hazard until lockout is completed. An Operational Safety Plan (OSP) or other approved written procedure is required. A second worker is required to be present until the electrical hazard has been isolated and verified. [See Document 16.1, "Electrical Safety," and Document 16.2, "Work and Design Controls for Electrical Equipment," in the *ES&H Manual* for details on working with electrical systems.]

The sequence of steps for locking out and tagging out equipment is as follows:

1. Prepare and notify.
    a. LOTO-authorized worker: Ensure that the facility point of contact (FPOC) or equipment supervisor, as applicable, has been notified that service or maintenance is to be performed on the equipment and that the equipment is to be shut down, locked out, and tagged out.
    b. LOTO-authorized worker: Make a log book entry, if applicable (see Section 3.12).
    c. FPOC (for facility equipment) or the equipment supervisor (for programmatic or service equipment): Notify all affected workers that service or maintenance [as authorized with an Integration Work Sheet (IWS)] is to be performed on the equipment and that the equipment is to be shut down, locked out, and tagged out.
    d. LOTO-authorized worker: Before proceeding with LOTO, (1) identify the type and magnitude of energy that the equipment uses, (2) understand the hazards of the energy involved, and (3) know the methods for controlling the energy sources.
2. Shut down the equipment.
    - If the equipment is operating, shut it down using the normal shutdown procedure (e.g., depress the stop button, open the switch, or close the valve).

3. Isolate the energy.

    - Isolate the energy by positioning the energy-isolating device (e.g., switch, circuit breaker, or valve) to positively isolate the equipment from the energy source.

4. Apply the LOTO devices.

    - Before servicing or maintenance begins, lock out the energy-isolating device with an approved LLNL LOTO lock and attach a completed LLNL LOTO tag. (See Section 3.6 for limitations.)

    - Verify that the lock is effective, e.g., by attempting to turn on the switch or open the valve as appropriate.

5. Control stored energy.

    - Relieve, disconnect, restrain, or otherwise render safe all sources of stored energy (e.g., capacitors; springs; elevated machine members; rotating flywheels; hydraulic systems; and air, gas, steam, or water pressure). Take steps to prevent the reaccumulation of stored energy, e.g., apply grounding devices to capacitors.

6. Verify and test.

    - Ensure that the equipment is disconnected from all energy sources. First check that no one is exposed, and then verify that the equipment is isolated by (1) attempting to start the equipment and (2) testing the equipment with appropriate test instruments to verify that the equipment is deenergized.

    - Whenever working near normally energized equipment or parts, use appropriate test instruments to verify deenergization. Test instruments shall be verified as operational both before and after use.

    - Return all operating controls to the neutral (i.e., off) position after verifying that the equipment is isolated.

3.2 Written, Equipment-specific LOTO Procedures

A written, equipment-specific LOTO procedure is required for any equipment that has more than one energy source or that does not otherwise meet all of the criteria in Section 3.1. [Examples of multiple energy sources include equipment that is fed by more than one circuit breaker or by equipment that exposes workers to a combination of energy hazards, such as electricity and pressurized gas. See Document 3.4.

Posted or other equipment instructions do not, by themselves, constitute a "procedure" but may be a component of a procedure that conforms to Document 3.4.

A written LOTO procedure shall:

- Identify the equipment that is covered and incorporate steps 1 through 6 of Section 3.1.2 and the procedure specified in Section 3.7, as applicable.
- Provide specific information for each step about the equipment and the associated energy hazards.
- Clearly identify all of the energy-isolating devices for the equipment.
- Provide any other information that is necessary to safely shut down the equipment and to isolate, test, and control all hazardous energy sources.

A written LOTO procedure shall be included in, attached to, or referenced in an IWS, OSP, or Facility Safety Plan (FSP). A written LOTO procedure may be a separate document approved and maintained by the equipment supervisor. In either case, the written LOTO procedure shall be readily available to any LOTO-authorized worker and for periodic inspection.

An equipment-specific written LOTO procedure may reference instructions that are prominently posted on the equipment. The equipment supervisor shall ensure that equipment is marked or labeled to indicate to maintenance workers that a written procedure applies to that equipment.

Similar machines or pieces of equipment (i.e., those having the same type and magnitude of energy) that have substantially similar methods of energy control may be covered by a common procedure. A common procedure shall include a method of identification that ensures that the LOTO-authorized worker can determine which procedure applies to each piece of equipment. This procedure shall clearly identify the following elements:

- Types and locations of equipment operating controls.
- Types and locations of energy-isolating devices.
- Types of stored or residual energy and methods to dissipate or block that energy.
- Methods of verifying isolation of the equipment.

3.3 Group LOTO

If the number of workers performing a maintenance activity makes it impractical for each of them to apply LOTO devices directly to the energy-isolating device(s), a group LOTO may be used.

When service or maintenance is performed by a crew, craft, department, or other group working together, the following procedures shall be followed to provide those personnel a level of protection equivalent to that of a personal LOTO device.

a. One LOTO-authorized worker, designated as the LOTO group leader by the group's supervisor, shall have primary LOTO responsibility for a defined number of other personnel working under the protection of a group LOTO.

b. The LOTO group leader shall ascertain the exposure status of individual group members with regard to the LOTO procedure for the equipment.

c. The LOTO group leader shall disable the equipment and apply LOTO devices to the equipment in accordance with all of the steps in Section 3.1. or 3.2, as appropriate.

d. The LOTO group leader shall place all keys in a group lockbox or comparable mechanism.

e. Each LOTO-authorized worker shall apply a lock to the group lockout device, group lockbox, or comparable mechanism before beginning work, and shall remove the lock after stopping work on the machine or equipment. Each lock shall be equally effective in preventing energy flow to the equipment

f. When more than one crew, craft, or department is involved, the LOTO group leader shall be responsible for the overall job-associated LOTO procedure, which includes coordinating the various groups and ensuring continuity of protection. Each LOTO-authorized worker in each crew shall apply a lock to the group lockbox, as described in (e) above, or a subgroup lockbox shall be used, as described in (g) below.

g. A LOTO-authorized worker from each crew or subgroup shall apply a lock to the group's lockbox or comparable mechanism before work begins and remove the lock after work is completed. The key to this lock shall be placed in a subgroup lockbox. Each LOTO-authorized worker in the subgroup shall apply a lock to the subgroup lockbox as described in (e) above. Each lock shall be equally effective in preventing the energy flow to the equipment.

3.4 Transferring Locks and Tags When Personnel or Shifts Change

To maintain continuity of protection for those involved in a LOTO procedure, and to ensure the orderly transfer of LOTO devices, the following procedures shall be followed when personnel or shifts change.

- When personnel change, the arriving LOTO-authorized worker's lock and tag shall be applied before the departing LOTO-authorized worker's lock and tag are removed.

- When shifts change, the lock and tag of at least one LOTO-authorized worker on the arriving shift shall be applied before any locks and tags of the departing shift are removed. The departing crew shall inform the arriving crew of the status of equipment and work in progress.

3.5 Removing Locks and Tags

LOTO locks and tags shall be removed only by the LOTO-authorized worker who applied them.

Exception: When the LOTO-authorized worker who applied a lock and tag is not present at the Laboratory, the lock and tag may be removed by the LOTO-authorized worker's work supervisor in coordination with the equipment supervisor and payroll supervisor, provided that all of the following conditions are satisfied:

- The LOTO-authorized worker's payroll supervisor and the equipment supervisor verify that the LOTO-authorized worker who applied the lock and tag is not at the Laboratory.
- All reasonable efforts shall be made to contact the LOTO-authorized worker who applied the lock and tag to
  - Inform the LOTO-authorized worker that the lock and tag are to be removed.
  - Determine the operational and safety status of the equipment.
- The work supervisor determines that the equipment or area is safe before the lock and tag are removed.

Furthermore, when a lock and tag applied by a LOTO-authorized worker are removed during that worker's absence from the Laboratory, the work supervisor shall not allow the worker to resume work until informing the worker that the lock and tag were removed.

3.6 Testing or Repositioning Equipment or Components

If a lock and tag need to be temporarily removed from an energy-isolating device to energize and test equipment or to reposition any equipment components, the LOTO-authorized worker(s) shall:

1. Clear the equipment of tools and materials, and ensure that all personnel are located safely away from the equipment.
2. Remove the locks and tags from the energy-isolating devices in accordance with the procedure in Section 3.7, steps 1–4.

3. Energize the equipment and then proceed with testing of the equipment or repositioning of the components.
4. Deenergize all systems, perform the steps in Section 3.1.2, and then continue with service or maintenance.

3.7 Restoring Equipment to Service

When service or maintenance is completed and the equipment is ready to be returned to a normal operating condition, the LOTO-authorized worker(s) shall:

1. Check the equipment and the immediate area to ensure that nonessential items are removed, that all components are operationally intact, and that all guards or other protective features are restored.
2. Check the work area to ensure that all personnel are located safely away from the equipment.
3. Verify that equipment controls are in the neutral position.
4. Remove the lock and tag, and then reenergize the equipment.

   (Some blocking devices may require reenergizing of the machine before the blocking device can be safely removed.)
5. Notify affected workers that service or maintenance has been completed and that the equipment is ready for use.
6. Complete the LOTO log, if applicable.

3.8 LOTO Requirements for Outside Subcontractors

Outside subcontractors (except supplemental labor workers, who are required to follow all requirements in this document) who engage in activities covered by the LLNL LOTO Program shall be required, when applicable, to include in their safety plans LOTO procedures that conform to the requirements in this document. All subcontractors are responsible for personally locking out and tagging out the equipment that they handle. A subcontractor supplies all of the required hardware and other materials to effectively implement the LOTO procedure.

The onsite supervisor (i.e., equipment supervisor for service vendors, program construction coordinator for program or facility projects that do not involve Plant Engineering, or construction manager for contracts that involve the Plant Engineering Department) shall ensure that a subcontractor's safety plan is consistent with LLNL LOTO requirements and 29 CFR 1910.147 (c)–(f). All subcontractors shall have their own LOTO program if subject to LOTO activities.

Subcontract workers (except supplemental labor workers) are not required to complete Course HS5245-CBT ("Lockout and Tag"), but each subcontractor shall train its employees (i.e., subcontract workers) in its own LOTO procedure. All subcontract workers (even those who do not personally lock and tag equipment) are potentially exposed to LOTO-related hazards and shall therefore be trained to understand the procedure for, and the importance of, using LOTO.

The onsite supervisor shall ensure that workers understand and comply with the outside subcontractor's procedures and are able to recognize the subcontractor's LOTO devices.

The onsite supervisor may elect to forbid a subcontractor from operating a system or equipment in either of the following cases:

- The subcontractor does not know how to appropriately lock out and test a particular piece of equipment.
- LLNL requires oversight of a utility that is associated with the subcontract work.

In the above cases, subcontractors are not relieved of their LOTO responsibilities. Furthermore, a LOTO-authorized worker of the cognizant LLNL group shall apply either a personal LOTO lock and tag or an administrative lock and tag, as appropriate. The lock and tag shall be applied to a multiple lockout hasp on the energy-isolating device after securing the system and demonstrating to the subcontractor's satisfaction that all of the energy has been neutralized. All subcontract workers are still responsible for applying personal locks and tags to the multiple lockout hasp before working on that system. After the work has been completed and all of the subcontractor's locks have been removed, the LLNL LOTO-authorized worker removes the LOTO lock and tag, and any administrative locks are removed by appropriate personnel before the system is reenergized.

3.9 Protective Materials and Hardware

The work supervisor shall provide LOTO-authorized workers with the appropriate locks and tags. The work supervisor shall also provide any additional locks and tags to the following workers if needed:

- Plant Engineering electricians.
- Heating, ventilation, and air conditioning (HVAC) mechanics.
- Plumbers.
- Authorized engineering, mechanical, or electronics technicians.
- Other authorized workers.

Normally, the equipment supervisor provides any special chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware required for isolating, securing, or blocking the equipment from energy sources.

In addition, personnel shall use personal protective equipment (PPE) when performing these activities, in accordance with the provisions of Document 11.1, "Personal Protective Equipment," in the *ES&H Manual*.

The approved LLNL LOTO lock is shown in Figure 1. Authorized employees can obtain locks from their supervisors, or by contacting their ES&H Team.

Figure 1. LLNL LOTO lock.

The lock shall be individually keyed, or the LOTO-authorized worker may have a set of locks that is keyed alike. No other person shall have the same key unless the LOTO-authorized worker decides to give a second key to the work supervisor for use only as described in Section 3.5, under "Exception." Under no circumstances shall there be more than two keys for a lock.

Lock mechanisms built into equipment are acceptable, provided that (1) such mechanisms isolate energy to the unit and that (2) the LOTO-authorized worker controls the keys.

LLNL LOTO tags (Figure 2) shall be used for all LOTO lockouts and shall have the name of the LOTO-authorized worker who applied them. That LOTO-authorized worker shall write all other applicable information on the tag.

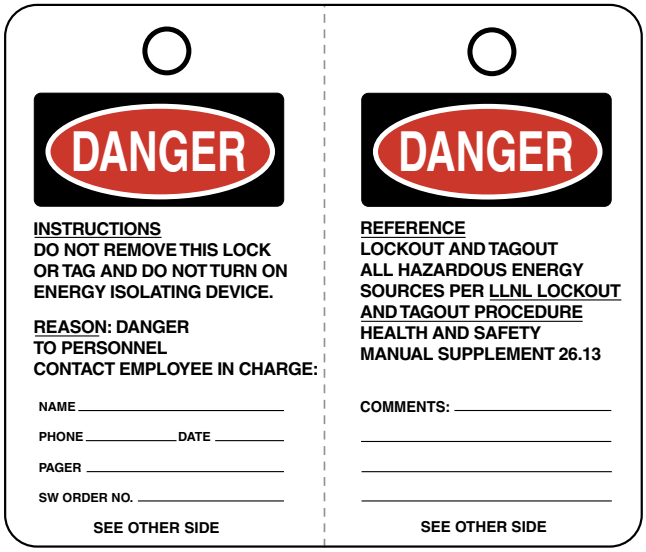

Figure 2. LLNL lockout tag, front and back (Form LLNL-DNR-30575-SLT, Stock No.4280-71737).[a]

a It is recognized that this LLNL LOTO tag uses the old reference to Health and Safety Manual Supplement 26.13, rather than the new reference, i.e., Document 12.6, "LLNL Lockout/Tagout Program," in the ES&H Manual. This LOTO tag may be used until the existing supply is exhausted.

For administrative or operational purposes, equipment may be tagged with a yellow CAUTION tag (Figure 3) or other appropriate tag, but not a LOTO tag. Use of a lock is optional. The LOTO lock (Figure 1) shall not be used as an administrative lock.. See Appendix A for the definition of an administrative lock.

Figure 3. CAUTION tag, front and back (Form LLNL-CNOC-30575-SLT, Stock No. 4280-71958). An example of an administrative tag.

3.10 Limitations of Energy-Isolating Devices

If an energy-isolating device cannot physically accept a lock:

- Use a lockable energy-isolating device (e.g., a panel board or switchboard feeding the nonlockable device) that has been approved by the equipment supervisor and facility management and that effectively isolates the device. Properly isolate, lock, and tag the device.

OR

- The equipment supervisor shall arrange to have a qualified person install a suitable lockout attachment or adapter on the energy-isolating device and then proceed with the LOTO process described in Section 3.1.2.

OR

- The equipment supervisor shall arrange to have a qualified person open (or close) the energy-isolating device (i.e., the circuit breaker or valve), disconnect the wiring or piping from the device (or insert a blank flange), tag the wiring or piping (or blank flange) and the energy-isolating device, and then proceed with the LOTO process described in Section 3.1.2.

  (Any tag used with disconnected wiring, as described above, or any tag used with a blank flange or physically disconnected piping shall indicate the point of disconnect or the location of the blank flange.)

OR

- Open (or close) and tag the energy-isolating device. Designate one person as a safety watch to ensure that the energy remains isolated for the duration of service or maintenance, and then proceed with the LOTO process in Section 3.1.2. A person designated as a safety watch shall have no other duties and shall not leave the station for any reason except when formally relieved from duty or for personal safety.

A lockable energy-isolating device shall be installed on equipment before personnel begin any service or maintenance work that could result in the unexpected release of hazardous energy. Nonlockable energy-isolating devices shall be designed or modified to accept a lock whenever any of the following is performed:

- Equipment is replaced.
- New equipment is installed.
- A major modification is performed.

3.11 Periodic Inspections

The work supervisor or a LOTO-authorized worker (other than the workers being inspected) shall inspect LOTO procedures at least annually. This inspection shall include observing how well LOTO-authorized workers follow LOTO procedures and comply with the LLNL LOTO Program.

The work supervisor shall certify completion of the inspection by entering the name of the equipment, the date of inspection, and the names of the workers involved in the inspection (including the person who performed the inspection) on the LOTO Inspection Form (see Appendix B). A LOTO-authorized worker who is to perform the inspection shall be accompanied by the work supervisor, who shall observe whether work is being performed according to LOTO procedures.

Any discrepancies identified during inspection shall be documented on the LOTO Inspection Form and shall be corrected before that LOTO-authorized worker can perform further lockouts.

3.12 LOTO Logs

The requirements for maintaining logs and records of the status of facility systems are specified in Document 3.5, "Conduct of Operations for LLNL Facilities," in the *ES&H Manual*. LLNL recommends, but does not require, that a record of all LOTO operations be maintained, particularly when a lock and tag are to remain in place for more than one day. This recordkeeping may be accomplished using a log such as that available at the following Internet address:

http://www.llnl.gov/es_and_h/hsm/doc_12.06/images/appc26-13-log.gif

A LOTO log is required for any locks used for the deactivation or mothballing of a facility (see Section 1.4.1).

3.13 Training

This section describes LOTO-related training requirements.

3.13.1 Affected Workers

All new staff are introduced to the LLNL LOTO Program in Course HS0001 ("New Staff Safety Orientation") and in the handbook, *Safety at LLNL for Employees, Contractors, and Visitors*. An informational flyer that was mailed to all employees to briefly describe the program can be found at the following Internet address:

http://www.llnl.gov/es_and_h/hsm/doc_12.06/images/appd26-13-flyer.gif

Note that on this flyer, the reference to this document ("Supplement 26.13 of the *Health & Safety Manual*") is incorrect and should read as follows:

Document 12.6, "LLNL Lockout/Tagout Program," in the *ES&H Manual.*

Any questions about the LLNL LOTO Program should be directed to a supervisor or the directorate assurance manager.

3.13.2 LOTO-Authorized Workers

Each LOTO-authorized worker shall receive training to recognize applicable hazardous energy sources, the types and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control. This training shall include both computer-based training (Course HS5245-CBT, "Lockout and Tag") offered by the Hazards Control Department and on-the-job training for specific equipment.

3.13.3 Retraining

LOTO-authorized workers shall complete retraining (Course HS5245-RW, "Lockout and Tag—Refresher") at least every five years. Additional on-the-job training shall be required after any change of job assignment involving new energy control procedures or when there is a change in existing equipment, processes, or energy-control procedures.

Retraining shall be conducted if a periodic inspection reveals, or if the work supervisor has reason to believe, that a LOTO-authorized worker is not following the LOTO procedures properly or lacks the appropriate skills. Retraining shall reestablish personnel proficiency and introduce new or revised control methods and procedures, as necessary.

3.13.4 Training Records

LOTO training records shall be maintained in accordance with Document 40.1, "LLNL Training Program Manual," in the *ES&H Manual*.

4.0 Responsibilities

4.1 Affected Workers and LOTO-authorized Workers

This section describes the LOTO-related responsibilities of affected workers and LOTO-authorized workers.

4.1.1 Affected Workers

Affected workers are responsible for:

- Obtaining the training specified for affected workers in Section 3.13.1 of this document.
- Complying with all requirements of the LLNL LOTO Program. In particular, affected workers shall not attempt to operate or energize equipment or systems that are locked out or tagged out.

4.1.2 LOTO-authorized Workers

LOTO-authorized workers are responsible for:

- Performing LOTO procedures in accordance with the LLNL LOTO Program.
- Coordinating their activities with other LOTO-authorized workers when using the guidance in Section 3.3 for group lockouts and in Section 3.4 for transferring locks and tags when personnel and shifts change.
- Following equipment-specific LOTO requirements. This includes referring to applicable documentation to identify the type and magnitude of energy that the machine or equipment uses, understanding the hazards of the energy, and knowing the methods to control the energy.
- Participating in periodic inspections of LOTO procedures when asked to do so by the work supervisor.
- Obtaining the training and retraining specified for LOTO-authorized workers in Section 3.13.2 of this document.
- Notifying affected workers or equipment supervisors when service or maintenance needs to be performed on equipment and that the equipment needs to be shut down, locked out, and tagged out.

4.2 Equipment Supervisors

Equipment supervisors are usually responsible for one of three categories of equipment:

1. Programmatic equipment (i.e., equipment owned, operated, and maintained by a program).
2. Programmatic equipment that is maintained by the Plant Engineering Department.
3. Installed real property equipment that is maintained by the Plant Engineering Department.

4.2.1 Equipment Supervisors Responsible for Programmatic Equipment

These equipment supervisors are responsible for:

- Notifying all affected workers when service or maintenance needs to be performed on equipment and that the equipment shall be shut down, locked out, and tagged out.
- Ensuring that equipment with a written procedure is appropriately labeled.
- Ensuring that procedures outline the techniques to be used to lock out and tag out sources of hazardous energy for equipment in their area of responsibility, when required. (See Section 3.2 for guidelines.)
- Exchanging information about their respective LOTO procedures with outside subcontractor supervisors.
- Ensuring that their personnel understand and comply with outside subcontractors' LOTO procedures.
- Verifying that appropriate training has been provided to those affected workers working in the facility. (Providing such training is the responsibility of the program supervisor.)
- Providing LOTO-authorized workers with any required equipment (including PPE and locks and tags) that is not available from the work supervisor.
- Providing any special chains, wedges, blank flanges, key blocks, adapter pins, self-locking fasteners, or other hardware required for isolating, securing, or blocking energy sources.

4.2.2 Equipment and Work Supervisors Responsible for Programmatic Equipment Maintained by the Plant Engineering Department

Both programmatic equipment supervisors and Plant Engineering equipment and work supervisors are assigned responsibilities for programmatic equipment maintained by the Plant Engineering Department.

Programmatic equipment supervisors are responsible for:

- Notifying all affected workers when service or maintenance needs to be performed on the equipment and that the equipment needs to be shut down, locked out, and tagged out.
- Ensuring that equipment with a written procedure is appropriately labeled.

- Ensuring that procedures outline the techniques to use to lock out and tag out sources of hazardous energy for equipment in their area of responsibility, when required. (See Sections 3.2. for guidelines.)
- Verifying that appropriate training has been provided to those affected workers working in the facility. (Providing such training is the responsibility of the program supervisor.)
- For a unique piece of equipment, providing any special chains, wedges, blank flanges, key blocks, adapter pins, or self-locking fasteners; any additional locks and tags if an unusually large number is required; or any other hardware required for isolating, securing, or blocking energy sources.

Plant Engineering equipment and work supervisors are responsible for:

- Writing procedures (when required) that describe the techniques to use to lock out and tag out sources of hazardous energy for equipment in their area of responsibility. (See Section 3.2.)
- Ensuring that equipment with a written procedure is appropriately labeled.
- Notifying the FPOC when service or maintenance needs to be performed on the equipment and that the equipment needs to be shut down and locked out.
- Exchanging information about their respective LOTO procedures with outside subcontractor supervisors.
- Ensuring that their personnel understand and comply with outside subcontractors' LOTO procedures.
- Providing equipment to the Plant Engineering Department and LOTO-authorized workers. This equipment includes locks and tags, standard lockout adapters, and other fixtures.

4.2.3 Equipment and Work Supervisors Responsible for Installed Real Property Equipment Maintained by the Plant Engineering Department

Both equipment supervisors within a facility and Plant Engineering work supervisors are assigned responsibilities for installed real property equipment maintained by the Plant Engineering Department.

Equipment supervisors within a facility are responsible for:

- Notifying all affected workers when service or maintenance needs to be performed on the equipment and that the equipment needs to be shut down, locked out, and tagged out.

- Ensuring that assigned equipment has a Plant Engineering identification number and that the energy sources are labeled, as necessary.
- Ensuring that written LOTO procedures are developed for equipment that has multiple energy sources or that does not otherwise meet all of the criteria set forth in Section 3.1.
- Ensuring that equipment with a written procedure is appropriately labeled.
- Verifying that appropriate training has been provided to those affected workers working in the facility. (Providing such training is the responsibility of the program supervisor.)

Plant Engineering work supervisors are responsible for:

- Writing procedures (when required) that describe the techniques to use to lock out and tag out sources of hazardous energy for equipment in their area of responsibility. (See Section 3.2.)
- Notifying the FPOC when service or maintenance needs to be performed on the equipment and that the equipment needs to be shut down and locked out.
- Exchanging information about their respective LOTO procedures with outside subcontractor supervisors.
- Ensuring that their personnel understand and comply with outside subcontractors' LOTO procedures.
- Providing equipment to Plant Engineering LOTO-authorized workers. This equipment includes locks and tags, PPE, standard lockout adapters, and other fixtures.
- Providing, for a unique piece of equipment, any special chains, wedges, blank flanges, key blocks, adapter pins, or self-locking fasteners; any additional locks and tags if an unusually large number is required; or any other hardware required for isolating, securing, or blocking energy sources.

4.3 Work Supervisors

Work supervisors are responsible for:

- Ensuring that all personnel under their supervision understand the purpose of the LLNL LOTO Program and have been trained in their responsibilities as affected workers.
- Ensuring that LOTO-authorized workers under their supervision have the knowledge and skills required for the safe application, use, and removal of energy controls.

- Ensuring and certifying that periodic inspections of the LOTO procedures used by LOTO-authorized workers are conducted.
- Providing equipment, including locks, tags, and PPE, to LOTO-authorized workers.
- Removing LOTO devices in accordance with the guidance in Section 3.5 when the LOTO-authorized worker who applied them is not available.

Work supervisors who supervise LOTO-authorized workers are encouraged to take Course HS5245-CBT ("Lockout and Tag").

4.4 Facility Points of Contact

The FPOC is responsible for notifying equipment supervisors and other affected individuals when facility equipment needs to be shut down and locked out.

4.5 Payroll Supervisors

Payroll supervisors are responsible for assuring that all required training is completed by LOTO-authorized workers.

4.6 Hazards Control Department

The Hazards Control Department is responsible for providing Course HS5245-CBT, "Lockout and Tag," and the corresponding refresher course, i.e., HS5245-RW, "Lockout and Tag—Refresher."

5.0 Work Standards

29 CFR 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*.

6.0 Resources for More Information

6.1 Contacts

For further information on the LLNL LOTO Program, please contact the Hazards Control electrical safety engineer.

6.2 Other Sources

LLNL High Voltage Distribution System Operation Manual, Lawrence Livermore National Laboratory, Plant Engineering Department.

LLNL Personnel Policies and Procedures Manual, Lawrence Livermore National Laboratory, Livermore, California (M-105).

Safety at LLNL for Employees, Contractors, and Visitors, Lawrence Livermore National Laboratory, Livermore, California, UCRL-TB-135511, October 1999.

Appendix A

Terms and Definitions

Administrative lock	Any lock that is used for a purpose other than LOTO. The lock may serve a safety function other than LOTO, a configuration control function, or other purpose. An administrative lock, unlike a LOTO lock, may be controlled by one or more individuals. An administrative lock shall not be labeled with a DANGER tag or sticker (see Figure 1 in Section 3.9). An administrative lock is not a substitute for a LOTO lock. A LOTO lock cannot be used as an administrative lock.
Administrative tag	Any tag that is used for a purpose other than LOTO. The tag may serve a safety function other than LOTO, a configuration control function, or other purpose. An administrative tag, unlike a LOTO tag, may be controlled by one or more individuals. The CAUTION tag, shown in Figure 3 in Section 3.9, is an example of an administrative tag.
Affected worker	An LLNL worker or supplemental labor worker who is not performing servicing or maintenance on equipment but who typically operates or works in the vicinity of such equipment.
Energized	Connected to an energy source or containing residual or stored energy.
Energy-isolating devices	Mechanical devices that physically prevent the transmission or release of energy, including, but not limited to, the following: • Manually operated electrical circuit breaker. • Disconnect switch. • Manually operated switch that disconnects the conductors of a circuit from all ungrounded supply conductors and that does not allow the poles to be operated independently. • Line valve. • Block. • Similar device used to block or isolate energy. Pushbuttons, selector switches, interlocks, and other control circuit-type devices are not energy-isolating devices.

Energy source	Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy. The term "multiple energy sources" includes equipment using more than one form of energy or more than one source of the same type of energy, e.g., two electrical circuits that are controlled independently of one another.
Equipment supervisor	The person designated by management to be in charge of a piece of equipment. For example, this person may be an FPOC, principal investigator, Responsible Individual, Plant Engineering craftsperson, or administrative specialist. The equipment supervisor is the responsible user or caretaker of the equipment, which may be programmatic equipment or installed real property. The equipment supervisor is usually the first person to notice (or have reported to him/her) that a piece of equipment is not working properly. An equipment supervisor may also be a LOTO-authorized worker.
General LOTO	The required energy isolation and control procedure for any equipment or machine that does not have an equipment-specific written procedure. General LOTO is only used on equipment that is easily disconnected from all energy by a single disconnecting means and that meets all of the other criteria listed in Section 3.1.1.
Installed real property	Equipment including building air conditioners, substations, and building power and distribution systems. Usually, installed real property equipment is maintained by the Plant Engineering Department, and the cost of maintenance is charged to the Plant Engineering maintenance and operation accounts.
Isolation (of energy)	The prevention of the transmission of hazardous energy by means of a direct, positive method, such as opening a circuit breaker or closing a valve. Indirect means, such as control switches and interlocks, are not permissible isolation methods.
LOTO	Lockout and tagout. Specifically, the applying of a lock and associated identifying tag to an energy-isolating device in accordance with an established procedure to ensure that the device and equipment being controlled cannot be operated until the lock and associated tag are removed.

LOTO-authorized worker	A worker who locks out or tags out machines or equipment to perform service or maintenance. An affected worker may become a LOTO-authorized worker only when all of the following apply: • The person's duties include performing service or maintenance activities covered under the LLNL LOTO Program. • The person has completed the training requirements for the LLNL LOTO program. • The person has been authorized by his or her supervisor.
LOTO tag	An approved LLNL form (see Figure 2 in Section 3.9) that can be securely fastened to an energy-isolating device with a lock in accordance with procedures established in the LLNL LOTO Program. This tag indicates that the energy-isolating device and the equipment being controlled shall not be operated until the lock and tag are removed.
Outside subcontractors	Service and maintenance contractors, construction contractors, salvage contractors, and labor-only contractors.
Other workers	Workers, other than LOTO-authorized workers and affected workers, who work in an area where LOTO procedures may be used.
Payroll supervisor	The person who is administratively in charge of LOTO-authorized workers assigned to perform maintenance, including the locking out and tagging out of equipment. The payroll supervisor ensures that LOTO-authorized workers are trained, assigns activities to LOTO-authorized workers, maintains a list of their names, has access to their training records, and is usually the person who writes LOTO-authorized workers' performance appraisals. A payroll supervisor may also be the work supervisor of a LOTO-authorized worker.

Personal protective equipment (PPE)	Appropriate protective equipment, including personal protective equipment for eyes, face, head, and extremities; protective clothing; respiratory devices; and protective shields and barriers. Such equipment shall be provided, used, and maintained in a sanitary and reliable condition for use wherever there are hazards capable of injuring or impairing the function of any part of the body through absorption, inhalation, or physical contact. Such hazards include those from processes or environment, chemical hazards, electrical hazards, radiological hazards, and mechanical irritants.
Programmatic equipment	Equipment used for programmatic purposes, including lasers, power supplies, vacuum pumps, and walk-in refrigerators. This type of equipment may be maintained by programmatic personnel, or the program may have an arrangement with the Plant Engineering Department for maintenance.
Safety watch	A person designated and assigned by the work supervisor to assist a LOTO-authorized worker in performing maintenance or service on equipment that has no lockout attachment. This person shall be posted at an unlocked energy-isolating device to ensure that the device is not operated for the duration of the operation. The safety watch shall have no other duties and shall not leave his or her station for any reason except when formally relieved from duty or for personal safety.
Service or maintenance	Workplace activities that include constructing, installing, setting up, adjusting, inspecting, modifying, maintaining, or servicing machines or equipment. These activities also include lubricating, cleaning, or unjamming machines or equipment and making adjustments or tool changes in which personnel may be exposed to the unexpected energization of the equipment or release of hazardous energy.
Testing	Determination whether machinery, equipment, or equipment parts are deenergized. Testing involves the use of approved, properly operating test equipment designed for determining if any energized conditions exist.
Verify	To perform appropriate measurements and attempt to operate equipment controls, after an energy-isolating procedure has been performed but before maintenance or repair work is initiated, to determine that the hazardous energy has been isolated and the equipment cannot be energized or restarted.

Work supervisor	The person designated by management to be the day-to-day supervisor of a LOTO-authorized worker. A work supervisor may be the payroll supervisor of a LOTO-authorized worker assigned a specific, short-term duty in an area. LOTO-authorized workers assigned duties in more than one area may have more than one work supervisor. A work supervisor shall assure that LOTO-authorized workers are trained and qualified to perform assigned tasks. A work supervisor may also be a LOTO-authorized worker.

Appendix B

LOTO Inspection Checklist and LOTO Inspection Form

Work supervisors shall ensure, by onsite observation, that LOTO-authorized workers adhere to the requirements of the LLNL LOTO Program. Use the checklist below, and then complete the LOTO Inspection Form in this appendix.

LOTO INSPECTION CHECKLIST

Knowledge of LOTO-Authorized Workers

- Can the LOTO-authorized worker demonstrate knowledge about:
  - The LLNL LOTO Program?
  - The appropriate lockout and tagout devices?
  - The location of all energy-isolating devices?
  - All secondary or residual energies (if applicable)?
  - The energy-isolation verification procedures?
  - The procedures necessary for equipment that does not have a lockable energy-isolating device (if applicable)?
  - The log-keeping requirements?

Training

- Has the LOTO-authorized worker received the required training?

Lockout and Tagout Devices

- Is there an adequate number of locks and tags?
- Is the standard LLNL LOTO lock being used?
- Is the correct version of the LLNL LOTO tag being used?
- Is a LOTO log available (if required) and up to date?

Equipment

- Are energy-isolating devices properly labeled?
- Are energy-isolating devices lockable?
- Are energy-isolating devices (other than electrical devices) required for LOTO (e.g., valves)?

- Are valves adequately identified, and are suitable locking devices available?
- Are other devices (e.g., blank flanges, blocks, or chains) required for LOTO, and are these devices available?
- Are copies of the applicable energy control procedures available?

LOTO INSPECTION FORM

This form shall be completed by the work supervisor (or designated LOTO-authorized worker) who inspected the LOTO-authorized worker's use of LOTO procedures. The work supervisor confirms performance of the inspection by signing this form.

Date _____

1. List the equipment/machines on which the LOTO procedure is being used.

   _____

   _____

2. Provide the names of the LOTO-authorized workers who performed the LOTO procedure that was inspected.

   _____ _____

   _____ _____

3. Identify any discrepancies uncovered by completing the LOTO Inspection Checklist. List any corrective actions.

   _____

   _____

   _____

   _____

_____ _____

Signature of inspector Date

_____ _____

Signature of work supervisor Date